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LAKE FLIXTON;
A LATE-GLACIAL STRUCTURE

By JOHN MOORE.

Recent publications (1) have made available many of the facts relating to the 10,000 years old Middle Stone Age settlements sited towards the coastal end of the Vale of Pickering in North-East Yorkshire. The Star Carr settlement situated at the fringe of a prehistoric lake and the Flixton settlements upon an island towards the centre of it, have both yielded very vivid details of this prehistoric era when hunters, subsisting primarily upon the wild creatures of the forests, employed only flint, stone, wood, bone and horn in that arboreal pursuit. That these people were related, probably inversely, to the Maglemoseans (People of the Great Bog, Denmark) is adequately demonstrated by their specialised equipment of flint implements, especially by their flint axes and microlithic points, but above all else by their special skill in utilising deer antler. From it they fashioned barbed points which elsewhere in Northern Europe have been found attached to wooden shafts, suggesting not only fish spears but also the more formidable weapons required for securing the larger parkland creatures, deer, elk and oxen.

This short survey, however, is concerned chiefly with the natural origins of the prehistoric lake rather than with the details of the ancient settlements which I have been primarily responsible for unearthing. Yet it is illuminating to observe how the affairs of these prehistoric peoples were entirely subservient to Nature.....unplanned affairs in which the idea of controlled food-production was entirely alien; affairs always secondary to climatic, vegetational and faunal changes.....for these men and women were indeed at one with the wild creatures of the forests and swamps. At Flixton the amelioration in climate that permitted an Arctic lake to become transformed into a relatively temperate one surrounded by birch scrub along with pine and willow....and at the water's edge succulent grasses....led in simple sequence to the immigration of a richer wild life and hence was fore-ordained the advent of hunters who elsewhere in a similar geography would be ever seeking fresh means of subsistence as Nature opened up or closed down their hunting grounds. This is very much the essence of the Flixton story concerning its Middle Stone Age occupants. For perhaps half a millenium Nature had turned the Flixton terrain into a larder, and around 7,000 B.C., many hunters in the course of their seasonal migrations—perhaps one route lay between the North Sea Lands and the Pennines—would become aware of its fruitful environs. And at Star Carr and Flixton Carr just such a group of people settled and there found Nature very kind.

Yet Lake Flixton, as an entity, remained quite unknown until my Site 1 Middle Stone Age excavations (1947-1949), in Flixton Carr, had neared completion. These excavations had been carried across a peat-capped hillock of gravel protruding through extensive peat deposits. The great scientific value of the site arose from the waterlogging which had persisted from the earliest times in the peaty quagmire at its flanks. Remains of past vegetation, fauna and a similar scatter of archæological material from the settlement had therein been preserved from the destructive effects of the atmosphere. From remains of this kind the prehistoric scene is being reconstructed, but for this work the palæo-ecologist needs to know much more than is offered by the remains of prehistoric settlement. The deep bog, for instance, suggested the possibility of ascertaining the climatic and vegetational features both long before and long after the period of prehistoric occupation. To that end a programme of hand-boring operations was instituted, along with sampling and the contouring of certain parts of the old land surfaces and lake bottom submerged beneath the peats and earlier sediments of the lake infilling.

Resulting from this work emerged two quite new and interesting facts. Firstly, the Site 1 settlement already known to have been struck upon an island, was now seen to be one of several occupying the westerly extremities of a much larger island; secondly, it was seen to be an island surrounded by very deep lake sediments—clays, gravels, muds and peats—which must have been deposited progressively since the end of the Ice Age itself. The discovery of the famous Star Carr settlement upon the distant littoral; its early exploration by myself and later by the Prehistoric Society under the leadership of Dr. Graham Clark, and the palæo-ecological researches among the lake deposits by the Department of Quarternary Research under the leadership of Dr. Harry Godwin, are details of common knowledge. I had also been able to make the discovery (at Site 2, Flixton) of Middle Stone Age material found to be stratified above an older deposit containing the remains of wild horses among whose bones there was an arrowhead of white flint. Along with this late-Glacial site and the several other Middle Stone Age settlements of Lake Flixton, its later meres also provided a water-side home for Early Bronze Age folk. I have found a small settlement of theirs at Manham Hill (Site 6) containing, among other things, food-vessel and grooved-ware potsherds.

But these details appear rather late in the story of the easterly end of the Vale of Pickering. There is indeed a large gap in time between its Middle Stone Age occupation of 10,000 years ago and the beginning of glacial retreat perhaps 25,000 years past when the Flixton region lay heavily enshrouded by ice. We are fortunate in being able to turn to the pioneer researches of Kendall (2) to whom we are indebted for a thesis on "The

Glacier-lakes in the Cleveland Hills'' and particularly for the many contained facts relating to the glacial geology of the Vale of Pickering at this early period. For present purposes it is sufficient to say that he observed that each valley debouching into the Vale of Pickering from the North had been at one time subject to a constraining agent that no longer existed. The gravel spread at the mouth of Forge Valley, for instance, does not deploy in the regular manner one would have expected, as is the case with the regular delta of the great Newton Dale overflow channel passing out at Pickering; instead it is aberrant in deploying westwards thus presenting a feature that can only be explained by presupposing the existence of a glacier abutting more or less upon the slopes of the Limestone Hills.

Pressing inland, the glacier-lobe had reached its maximum extension a little westwards of Wykeham and after a brief sojourn at that point retreat set in, the Forge Valley overflow became operative discharging its gravel-loaded waters westwards between the glacier-lobe and the rising foothills and producing the deformed delta now being worked commercially. Beyond Wykeham to the West stood the waters of Lake Pickering, its surface perhaps not less than 200ft. above present day sea-level Beyond this stage Kendall does not provide many facts pertinent to the phenomena of Lake Flixton. He did observe, however, following Carvill Lewis, Fox-Strangways and others, that a sort of morainic barrier running through Hunmanby closes the Vale at its easterly extremities and he also observed that at Seamer Station an immense gravel spread occupied the entrance to the valley which admits the railway to Scarborough. This gravel spread he believed was connected in some way with the Seamer valley and that nearby at Deepdale. Since, however, he provides no information concerning the final stages of ice-decay at the easterly and coastal end of the Vale of Pickering, it is that problem I now propose to discuss.

The geological structure of the coastal end of the Vale of Pickering differs quite considerably from its greater extension to the West. The roadway linking the foot of the Chalk Wolds with Seamer village more or less provides a boundary between two very dissimilar topographies. Westwards, apart from the Wykeham delta which does not pass very far southwards into the Vale, the terrain remains consistently flat and is, as is well-known, an alluvial plain built up of gravels, sands and warps. Here and there shallow peat deposits occur but nowhere in the general spread of alluvial material can one discern any large irregularities in the surface of the plain. Beneath this westerly region well-borings reveal a moderately regular structure of sands alternating with clays, both passing to a depth of approximately 100ft. In contrast the coastal region, delimited as noted by the Seamer/Staxton road, contains great surface irregularities—deep

hollows filled with late-Glacial and early post-Glacial sediments and pronounced hummocks of boulder, clay and gravel—which in their sound state of preservation must evidently have been spared the destructive levelling activity suffered by the western area, particularly that region beyond the Wykeham delta. A rather limited picture of the pleistocene structure of the Vale of Pickering can be gained from Fox-Strangways (3) list of well-borings.

The eastern part of the Vale, then, is distinctive in possessing features either absent or less-pronounced in the West; these consist of (a) hollows linking together to form an elongated depression which runs below Flixton village from Muston as its easterly extremity and towards Willerby Carr as its approximate western termination. (b) The Seamer/Deepdale gravel delta. (c) The coastal moraine. (d) The sands and chalk gravels of the Wold foot and (e) the hummocky features in and around the Flixton depression. It seems quite evident that the reduction in size of the retreating Wykeham glacier-lobe led directly to the formation of the Seamer/Deepdale deltaic deposits. It should also be noted that this delta reveals the same westerly aberration that Kendall observed at Ayton and at other places West of that place. Recent drainage works for the new Eastfield Estate situated between the Seamer and Deepdale valleys, and an additional programme of field works bringing the existing villages into the same drainage scheme, necessitated many deep cuttings being made in the region Cayton—Seamer—Ayton. Often 20ft. deep these cuttings revealed that the gravels of the Seamer/Deepdale delta did, in fact, possess a westerly aberration and that eastwards they passed imperceptibly into a red boulder clay of unknown thickness; and the latter was itself seen to be stratigraphically continuous with the massive deposits of red boulder clay of the coastal moraine. The re-opening of the Seamer valley clearly permitted the rapid egress of meltwaters pressing from the Scarborough district towards the Vale of Pickering. These waters destroyed the impeding moraine at the mouth of Seamer valley and laid down the gravel delta which, striking westwards, must as Kendall noted for Wykeham, indicate the former presence there of the same constraining agent. Similarly the influxing meltwaters may postulate the closure of the coastal region by ice in the North Sea bed, but the presence of a large body of ice there at this late period does indeed present a difficulty. It could be that the coastal region was heavily shrouded in moraine hence all water movement would be purely internal; however this would imply a similar impounding agent operating at the westerly exit of the Vale and while there is a distinct possibility that such a barrier did exist (a possible product of the glaciation of the Vale of York) this present survey merely indicates the nature of the problem and reserves comment.

But it is clear that the glacier-lobe abutting upon the Seamer valley must, in terms of reduced altitude alone, by that time have become considerably attentuated. We are most certainly dealing with the final effects of glaciation and must expect, as is the case, to find the Wykeham glacier-lobe impounded in a very short time within the confines of the coastal moraine—itself today no less than 130ft. above present-day sea level. At any rate the deep deposits of sand and chalk gravel stretching along the Wold foot from Folkton towards Sherburn must indicate the passage of meltwaters from the Hunmanby region towards the Vale of Pickering. The barely perceptible laminar structure of fine sand and chalk gravel along with certain internal structures, may suggest their deposition during conditions of excessive frost action and may therefore be referred in greater part to the peak of glaciation; but it is noticeable that this sand spread although confined almost to the Wold foot from Folkton to Staxton does at the latter place begin to spread widely, and without structural detail, well into the low-lying ground; and at Fox Covert Plantation immediately east of Staxton Carr there is a pronounced region of hummocky ground composed of hillocks of clayey gravel—perhaps a boulder clay—and other hillocks of laminated sands and silts which, in total, must represent some portions of the ground and englacial debris deposited during the final halt indicated by the Seamer deltaic deposits. Beyond this stage we may say that the glacial-lobe began to disintegrate vertically, hence the general spread of hummocky moraine common to the region immediately inside the coastal moraine.

It seems reasonable then to suggest that the elongated depression running below the Flixton carrlands—an elongated depression approximately 4 miles in length by about a half-mile at its broadest point—must have been produced during the final decay of the Wykeham glacier-lobe and it must have been left as a cast of the dwindling remnants of ice around which the ebbing floodwaters of Lake Pickering deployed. This linkage of kettle-holes later formed the Middle Stone Age arena of Lake Flixton but outside this zone a few isolated kettle-holes are known. One in particular at Seamer (the Mere, Seamer village) consists of a very large basin at least 30ft. in depth which is now filled by peaty sediments.

The occurance of a pocket of clay near the Brickyard Cottages situated a short distance S.E. of Seamer village and at an altitude of approximately 90ft. O.D., provides some indication of the depth of Lake Pickering during these final stages of its life. Later with the almost complete disappearance of ice the Lake Flixton depression also began to receive its first infilling, a stonefree clay, at horizons varying between 60ft. and 80ft. O.D. Of course, some caution is necessary regarding the identification of the stonefree clays of this region, excepting by laboratory

methods, for some of them could well be earlier deposits exposed by fluviatile denudation. But along the margins of Lake Flixton, at Star Carr, the relationship between the stonefree clay and the basal stratum is well brought out. The Star Carr Middle Stone Age site occupies a small bay in the southerly edge of a large gravel elevation which here forms a rounded spur passing eastwards into Lake Flixton. East of Star Carr bridge the gravels contain an extensive structure of laminated subglacial or englacial sands but passing westwards the deposit is entirely gravel. A few hundred feet downstream, however, the gravels decline and rise again to form a large pocket or channel : this contains a deep infilling of stonefree clay. It should be noted that the river is an artificial channel cut through the Star Carr gravel spur as part of the Yedingham and Muston Drainage Works of a century past.

The outline of Lake Flixton is not readily got at in its entirety but, generally speaking, it can be said to follow very closely the margin of the peat deposits where they encounter hard rising ground. The northerly shoreline, regarding the Seamer/Staxton road as the boundary of this present study, commences near the roadway at Star Carr House. From there it passes along the gravel-spur towards Star Carr Bridge. Moving eastwards the spur is rounded, a bay of easterly aspect is encountered, and then the lake margin passes into Seamer Carr a little distance to the north of Ling Lane. Between Ling Lane and Rabbit Hill exists a channel leading from Seamer village and its Mere. The carving of this channel along the line of Black Dike suggests that the carving agent, water, must have been at that time at quite a low level and it is consequently very difficult to visualise any great stretch of water having been present in the greater part of the Vale at that time. When the narrower reaches of the channel became vacated it would leave Lake Flixton as an entity barely related to the pleistocene Lake Pickering.

From Rabbit Hill the lake margin travels towards Manham Hill, first in a northerly direction then rounding it towards Holme Hill. From Holme Hill the line passes vaguely towards Carr Hill and Coulson's Carr, and then southwards into Cayton Carr where it turns due east and traverses the low ground below Killerby Carr. Thence via Lebberston Carr through uninteresting country towards Muston at the foot of the Wolds. Returning westwards towards Flixton Carr Farm (now Woodhouse Farm) the lake margins are not clearly demarcated due to the shallow incline from the Wold foot into the low-lying carrlands. From Woodhouse Farm the line travels northwards then westwards around a massive spread of laminated sands and silts; and thence to Flixton Carr House via Fox Covert Plantation.

An interesting and important feature of Lake Flixton is the presence in it of an immense island of clayey-gravel, some of it certainly a boulder clay, which rises somewhat centrally

through the lake deposits as a prominent mound immediately to the north of Flixton Bridge. The island possesses a peat-submerged extension which gives the whole the appearance of a crescentically-shaped end moraine. The submerged portion, in which is situated Sites 1, and 2, travels westwards towards Star Carr for about $\frac{3}{4}$ mile but then turns and halts near the triangular plantation situated midway between Star Carr Bridge and Flixton Bridge. The island is not intact in its length, having been breached in at least two places and these points are occupied by relatively shallow peat. Additionally I should reaffirm that the island is indeed surrounded by deep superficial deposits, all passing downwards beneath the flat surface of the carrland often to a depth of 25ft.

For the most part Lake Flixton rests in an undulating terrain of sand, clay, and both a light-coloured and a red boulder-clay. That no further glaciation ensued is clearly postulated not only by the preservation of the Lake Flixton depression but also by the continuity of its deposits through into Middle Stone Age times. We can therefore regard the Lake as being a late-Glacial structure and would therefore expect that some of the fluctuations in climate, generally better known in Northern Europe, would be reflected in its sediments. Indeed such is the case and the ample evidences that Lake Flixton affords would suggest the additional possibility of transferring the glacial history of this small region retrospectively towards the period of the Wykeham Halt noted by Kendall.

Much of the internal structure of Lake Flixton has already seen research and publication and it will, it is hoped, with the passage of time become fully detailed. It is not therefore the object of this present study to make a recapitulation of what has already been achieved; rather must those earlier details which hinder research be enumerated. Here we are concerned with events taking place shortly after the lake had acquired its early infilling of stone-free clay, and it seems reasonably evident that the period of deposition of this clay was one of slow accumulation of fine meltwater deposits in rather deep water. It does not seem to be arctic in character for one would have expected to find it to be laminated had it been so. In the depths off the Star Carr spur and in the vicinity of the island this clay deposit has not only suffered much denudation but is also overlain in places by either clean or muddy gravels. In fact the westerly extremity of the NE/SW-oriented island has also suffered a similar disturbance upon its northerly flanks, for here it has been subject to forces which caused a large displacement of its material over and upon the stone-free clay of its surrounds. Since evidence of watersorting among the gravels and muddy gravels of this period is strong, and in view of the extensive erosion of the stone-free clay elsewhere, one must infer not only the scouring

action of a large body of shallow water but also infer the presence of detached masses of floating ice impinging upon the southerly flanks of the island's extremities. In fact, this situation is strongly supported by the presence of small kettle-holes left by minor masses of ice stranded upon the body of the island.

Somewhat tranquil conditions set in shortly afterwards for the period is marked by the deposition of a thick layer of grey, calcareous lake mud—drying white and of easy dispersal. In its lower levels, especially where they rest upon the gravels, frost conditions are clearly depicted by its varved structure of alternating bands of fine and coarse sediments. For very beautiful evidence concerning events immediately contemporary with the period of deposition of the uppermost layers of this mud we must turn again to the island in Lake Flixton. Here at Site 2, situated within the curve of the River Hertford, the stonefree clay rests below a clean gravel; and upon the gravel occurs a thin layer of peat containing the remains of wild horses from among whose bones came a slim arrowhead of white flint. Above the peat occurs a thin layer of sandy material and this passes upwards into approximately 12 inches of fine gravel which is counterparted in the deep lake sediments by a similar deposit resting upon the calcareous lake muds. Over all is a capping deposit of late preboreal and early boreal peat whose lower levels yielded the remains of a Middle Stone Age hearth containing burned bones, charred willow twigs and flint implements. Finally, towards the modern surface, a thick band of yellow sand containing shale particles were encountered. At Site 1 this latter deposit contained Middle Stone Age material directly beneath it in the peat and the evidence from the site suggested two periods of occupation; it is therefore interesting to note that besides the hearth material of the Site 2 excavation there was also a layer of charcoals 2ft. above it and directly beneath the sand and shale silting horizon.

Clearly, and in conclusion, the Middle Stone Age occupation, circa 7,000 B.C., is but near the end of the Lake Flixton story. The peat containing the remains of wild horses may incidentally very well be equated by more specialised observers than myself to the birch/pine phase of the *Allerod* oscillation of Northern Europe, thus giving it a well-founded date around 12,000 years ago; and its capping gravels and certain associated marginal channels at the edge of the island above the site may well be referable to the solifluxion effects of the minor cold period which precedes in many places the advent of Middle Stone Age hunters. And indeed the story of these hunters, so evidently the creatures of nature, ends here at Lake Flixton somewhere around 6,000 B.C., coincident in time with the laying down of the sand and shale layer which was apparently a product of excessive spring action, of impeded drainage, and the general flooding of the prehistoric hunting territory.

LIST OF REFERENCES.

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   In the Proceedings of the Prehistoric Society. Vol. xv. 1949 (1950).

   (d) Yorkshire Evening Post, October 4th, 1950. By the Author. "News of 10,000 years ago from the North Riding."

   (e) Illustrated London News, October 29th, 1949. "A stone-age settlement discovered in Yorkshire." By Graham Clark.

   (f) Illustrated London News, February 3rd, 1951. "The hunter-fishers of mesolithic Yorkshire." By Graham Clark.

   (g) Scarborough Evening News, April, 1951. By the Author. "The story of the people of the east wind."

   (h) Mesolithic sites in the neighbourhood of Flixton, N.E. Yorkshire. Archæology: John Moore. For Palæo-ecology, see (c).
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   (i) Star Carr Second Report. Archæology: J. G. D. Clark. Palæo-ecology: D. Walker. Mycology: E. J. H. Corner. Zoology: F. C. Fraser and J. E. King.
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2. Kendall, P. F. A system of Glacier-lakes in the Cleveland Hills. From the Quarterly Journal of the Geological Society. August, 1902. Vol. lviii.

3. Fox-Strangways, C. The Water Supply of the East Riding of Yorkshire. Geological Survey Memoirs, 1906.

NOTE :—In view of the current archæological exploration of the Lake Flixton area and the probability that full information will not become available for some time, a map of the area covered by this brief survey is not provided. Reference should be made to the six-inch Ordnance Survey maps: Yorkshire, Sheets xciii, S.E., and xciv, S.W. and their southerly continuations. Edition of 1929.

*ERRATUM :—The statistical item, 'utilised flakes,' should be corrected from 21 in quantity, to 51. Note: A molar of Elk (*Alces Alces*) came from this Site 1 excavation and this now forms part of the Site 1 exhibit at Scarborough Museum. Fragmentary remains of *Bos. sp.*, *Cervus sp.*, and Pig were also recovered. Current excavations (June, 1951) at Site 1 (East) have already yielded a calcined fragment of a barbed antler (harpoon) point.